DOCUMENT RESUME

ED 048 342 TM 000 415

AUTHOR	Towne, Douglas C.
TITLE	Displaying Semantic Differential Data in Three-Dimensional Space.
INSTITUTION	Northwest Regional Educational Lab., Portland, Oreg.
PUB DATE	Feb 71
NOTE	20p.; Paper presented at the Annual Meeting of the American Educational Research Association, New York, New York, February 1971
EDRS PRICE	EDRS Price MF-$0.65 HC-$3.29
DESCRIPTORS	*Data Analysis, *Evaluation Techniques, *Models, Rating Scales, *Research Methodology, Statistical Analysis, *Test Construction, Test Interpretation, Test Results
IDENTIFIERS	*Semantic Differential

ABSTRACT

A technique for displaying and analyzing Osgood's Semantic Differential data in three -dimensional semantic space is described. The technique employs a square board, with equidistant drilled holes, in which are placed dowels of various lengths combined with labels of different shapes. Studies have found 3 major factors (Evaluation, Activity, and Potency) in analyzing reactions of diverse subjects to different concepts on rating scales. Although, used together, these factors allow greater discrimination than a unidimensional or bidimensional approach, there are difficulties in visualizing the relationships in three-dimensional data analyses. Methods for the preparation of instruments which allow balanced presentation and/or samplings of concepts, scales, origin and width of end points, are explained. These instruments, analyses, and the display technique facilitate quick and easy interpretation and presentation of semantic differential data. Several studies conducted during the past two years are used to illustrate both the approach and the type of displays resulting from various subject groups, scales, and concepts. Example displays are illustrated in a series of photographs. (TA)

Displaying Semantic Differential Data in Three-Dimensional Space*

Douglas C. Towne
Northwest Regional
Educational Laboratory

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY

ED048342

TM 000 415

ABSTRACT

A technique will be described for displaying and analyzing Osgood's Semantic Differential data in three-dimensional semantic space. Several studies conducted during the past two years will be used to illustrate both the approach and the type of displays resulting from various subject groups, scales, and concepts. Also to be explained are methods utilized to prepare instruments which allow for balanced presentation and/or samplings of concepts, scales, origin and width of endpoints. These instruments, analyses and display procedures facilitate quick and easy interpretation and presentation of semantic differential data.

The Semantic Differential (SD) is a potent research tool which deserves greater utilization in education research. One reason for underutilization may be the difficulty of conceptualizing three-dimensional semantic space. A simple technique for visually presenting the three dimensions of Osgood's semantic space will be the major emphasis of this presentation. Osgood and many others have generally found three major factors (Evaluative, Activity, and Potency) in analyzing reactions of diverse subjects to different concepts on different bipolar scales. These three dimensions, when utilized together, allow greater discrimination than a unidimensional or bidimensional approach. The difficulty of such three-dimensional analyses of data derives from lack of an easy means of visualizing such relationships. The purpose of this paper is to describe methods and procedures found to be helpful in the administration and analysis of such research.

The techniques described and illustrated allow for actual display of concepts within semantic space. Such displays facilitate both clarity in the analyses and clarity in reporting results through photographic reproduction of such displays. Clusters, isolates, and other groupings of concepts become obvious. With such visual displays, the technique is inexpensive and simple, thereby affording more differential analyses than might usually be attempted.

---

*Presented at the 55th annual meeting of the American Educational Research Association in New York, N. Y., February 4, 1971.

Several studies will be described to illustrate both the techniques of instrument construction and the procedures of data exploration and analysis. Using various subject groups, concepts, scales, and instrument formats, these studies illustrate ways of counterbalancing structural elements of the instrument and ways of obtaining internal samples of subjects, concepts, and/or scales. The methods of plotting the resulting data are especially helpful in taking full advantage of three-dimensional semantic space, as opposed to the more usual unidimensional approach.

The studies conducted by the author (or with his assistance) will be utilized to illustrate both the instrument construction and display analysis techniques. These studies deal with such topics as an open-speaker policy issue on a university campus, a school dropout study, and an institute evaluation. (The studies will be used only for illustration, not for presentation of findings.)

The suggested techniques should lead not only to greater utilization of the semantic differential technique, but also to greater indepth analyses of the resulting data. Concepts (or words) are essential elements of all educational endeavors. Without greater clarity of the differing perceptions to such concepts, education will needlessly flounder in misinterpretation. The semantic differential techniques as outlined in this paper should find great utilization in studying such disparities of perceptions. (The display techniques could also be most useful in other areas utilizing three-dimensional measures.)

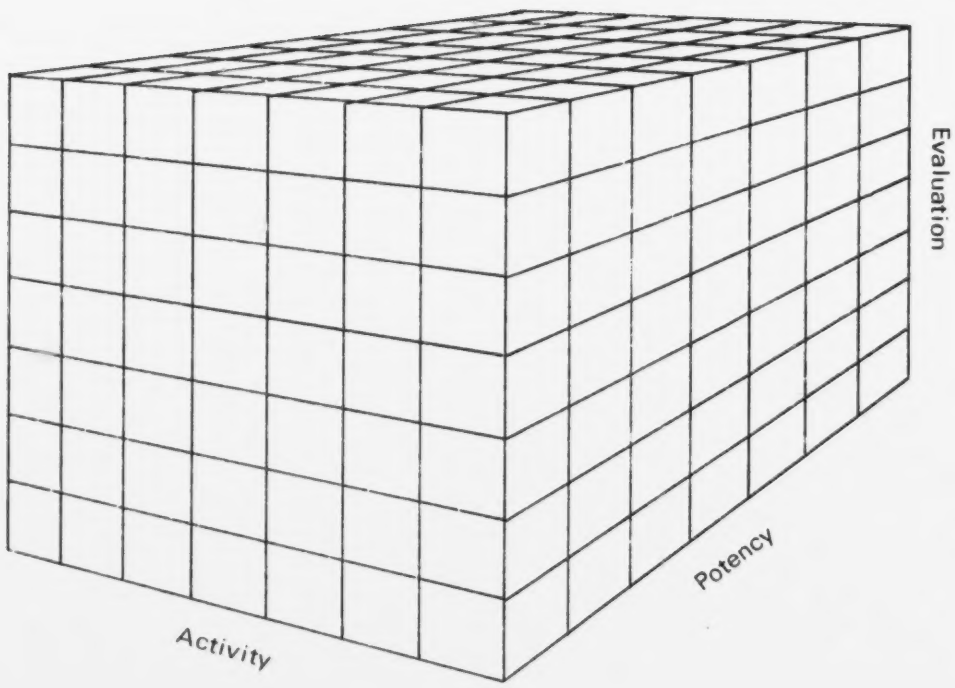
This paper concentrates on the conceptual analysis of SD data, as opposed to sophisticated statistical analyses. This emphasis is not intended to disparage the importance of various statistics as used in analyses of such data. Rather it is intended to illustrate a means to conceptualize and illustrate such statistical analyses more easily. It is also maintained that these displays may prove useful in educational situations using only the simplest of statistical tools.

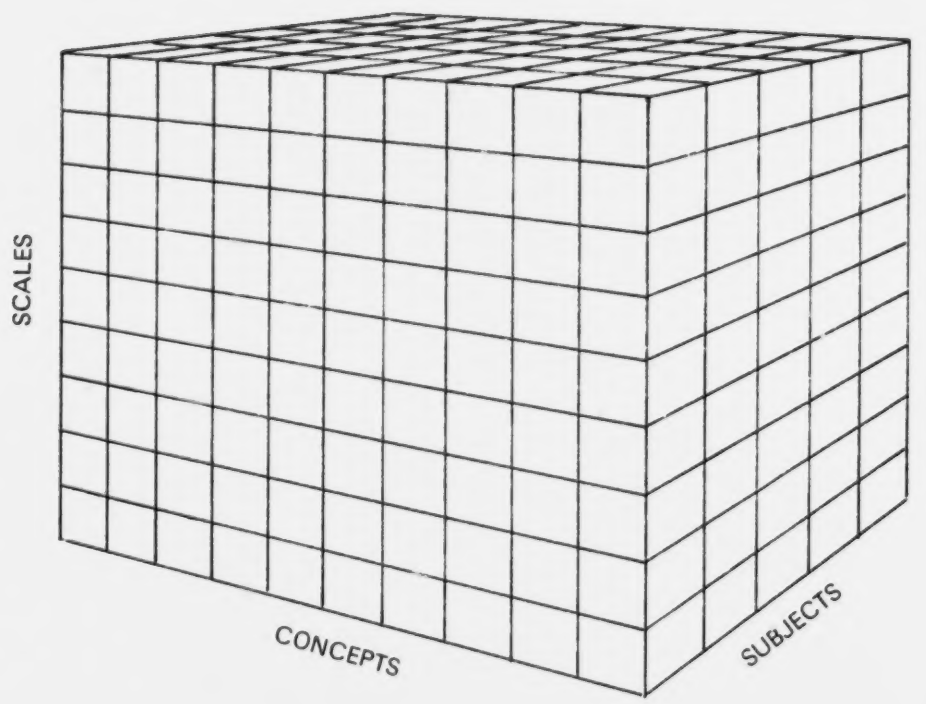
Semantic Space Displays

Heise (1969, p. 412) states that: "Factor analyses of SD data consistently show that there are three major dimensions of rating response--Evaluation, Activity, and Potency. Studies dealing with a great variety of scales, stimuli, and subjects have demonstrated the prominence and significance of the EPA structure in SD data." These major factors form Osgood's three-dimensional semantic space (Figure 1A). Location within the dimensions of semantic space is determined by the mean (or median) scores of an individual's or groups' responses to two or more scales for each of the three factors. Thus it is possible to combine a number of separate responses, made on a series of seven point scales, into a single observation located within a three-dimensional space. As shown in Figure 1A, the dimensions of this space are Activity (A), Potency (P), and Evaluation (E). (Though the independence of these three factors may still be questioned, they do remain useful analytical tools.)

Figure 1.

(A)





(B)

FIGURE 1. SD DATA MATRICES

Osgood (1957, p. 86) also illustrates tri-dimensionally the "rectangular solid of data generated by the semantic differential" (Figure 1B). Here the three dimensions are scales, concepts and subjects to which he suggests the addition of the dimension of time (Osgood, pp. 86-87). The researcher is then faced with the options of either utilizing k scales with m concepts given t times to n subjects or he may combine scales into k' factors presented with m concepts, given t times to n subjects. In addition it is possible to group subjects (n') and/or concepts (m')* and/or times (t'). The alternatives available are, therefore, a four-dimensional matrix of scores (k x m x n x t) with all elements ungrouped or the options of collapsing (summation) along one or more of the dimensions.

Such multi-dimensional data is somewhat difficult to portray and conceptualize. Figure 2 illustrates three familiar ways of graphically presenting SD data. Figure 2A is a common method (Osgood 1957, p. 90) of presenting the response of a single subject (or group means) to concepts A, B, C, and D on scales a, b, c, d, e and f. (The letters a - f might also represent factor means.) Such a method allows easy perception of similarities such as between concepts A and B. The similarity of response patterns between B anc C is not so simple, however, due to their polarity. In addition, <u>differences</u> such as shown by D in comparison to A, B and C are even more difficult to conceptualize. The addition of still more concepts, and/or subjects, and/or times contributes further to the confusion.

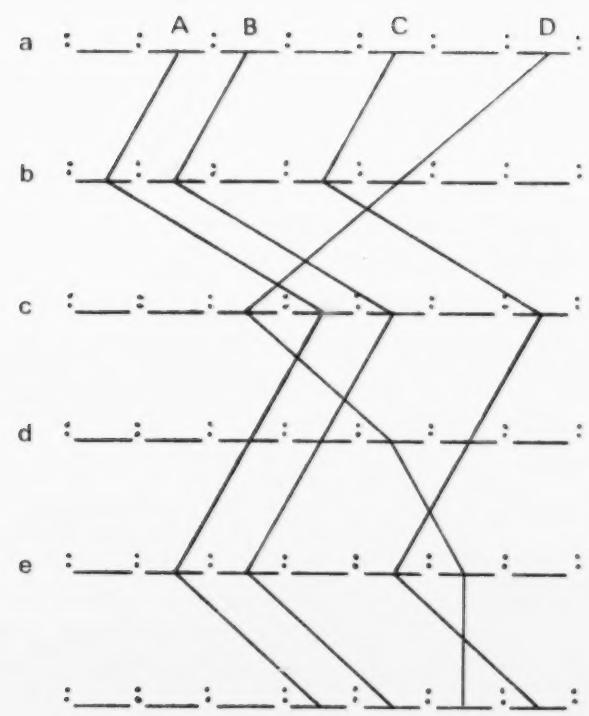
The method illustrated in Fibure 2B (Osgood 1957, p. 262) utilizes Osgood's distance measure to plot concepts (A-G), in relation to neutrality (darkened circle), within semantic space. Such an approach is helpful in many ways but the lack of reference points, other than neutrality, is a hindrance especially if several such diagrams are to be compared. Figure 2C (Osgood 1957, p. 114) adds the needed reference points by showing the grid formed by the factors of Activity and Potency located at the center of the vertical Evaluative scale. Here again are difficulties, however, such as the lack of clear discrimination between concept A (a plus score on Evaluative) and concept B (a minus score on Evaluative).

A desire to improve upon these representations led to the development of the SD display board. Consisting of nothing more than a square board with equidistant drilled holes and a collection of varied length dowels and different shaped labels, the SD display board allows three-dimensional displays of data which greatly facilitate analysis and conceptualization of SD data. The use of such a display board will be illustrated through brief summaries of various studies.

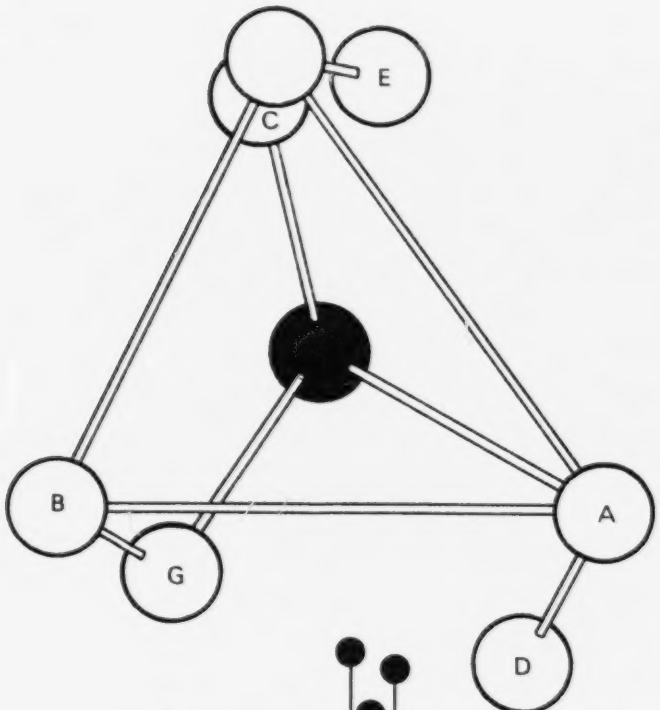
---

* Osgood (1957, p. 87) warns against grouping concepts, however on page 17 there is presented an example of concept grouping which shows promise.

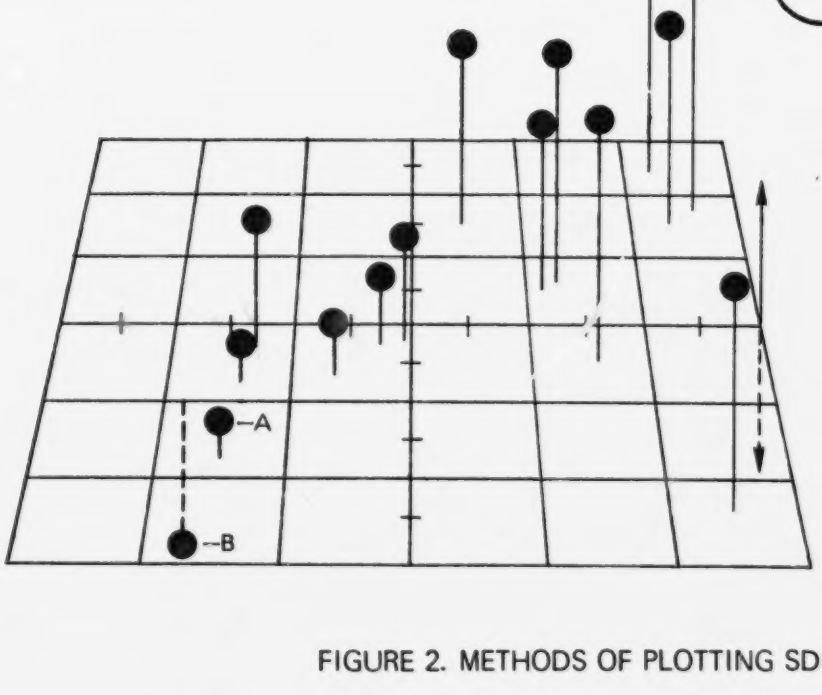
Figure 2.



(A)



(B)



(C)

FIGURE 2. METHODS OF PLOTTING SD DATA

Open-Speaker Policy Study

In the spring of 1969 the author led a university class through a learning experience in scale construction to illustrate how SD might be applied to assessment of public feelings toward a prominent issue. The major issue on campus at the time was an effort of student leaders to bring about a completely open policy toward inviting speakers, i.e., student organizations would have complete freedom to invite anyone they wished to speak.

This issue brought before the students several individuals and concepts which were then incorporated as stimuli in the SD. The instrument was administered to five selected campus groups. The results of the different group reactions are presented in Figures 3 to 7. (The label shapes distinguish between groups.)

Figure 3 presents the EPA mean scores for the four major student government leaders. The Activity mean score is plotted from left (1 or -3) to right (7 or +3); the Potency mean score is plotted from front (1 or -3) to back (7 or +3); and Evaluative from bottom (1 or -3) to top (7 or +3). (As indicated by the drilled holes, the means were rounded to the nearest half-point.)

This display from individuals deeply involved in the issue shows great dispersion and range of scores. A clear cluster of concepts (or individuals) which are closely associated appears in the upper right-hand corner.

Figure 4 displays scores generated by leaders of the Women Student Government who were also involved in the issue. Figures 5 and 6 are also scores from females, but here they were members of an undergraduate dorm or a senior seminar in Home Economics. Figure 7 displays the results of members of a campus fraternity.

When the five displays are placed side by side the differences appear rather striking. Most obvious is the steady reduction in dispersion or range of scores from Figure 3 to Figure 7. In addition to this overall observation, each concept is easily comparable from one group to another. (The difficulty in reading labels is merely technical and easily alleviated as the next illustrations will show.)

With these five display boards it became very easy to conceptualize the data generated by 3 factors, 18 concepts and 5 groups of subjects. The same amount of data in tabular form would be much more difficult to perceive.

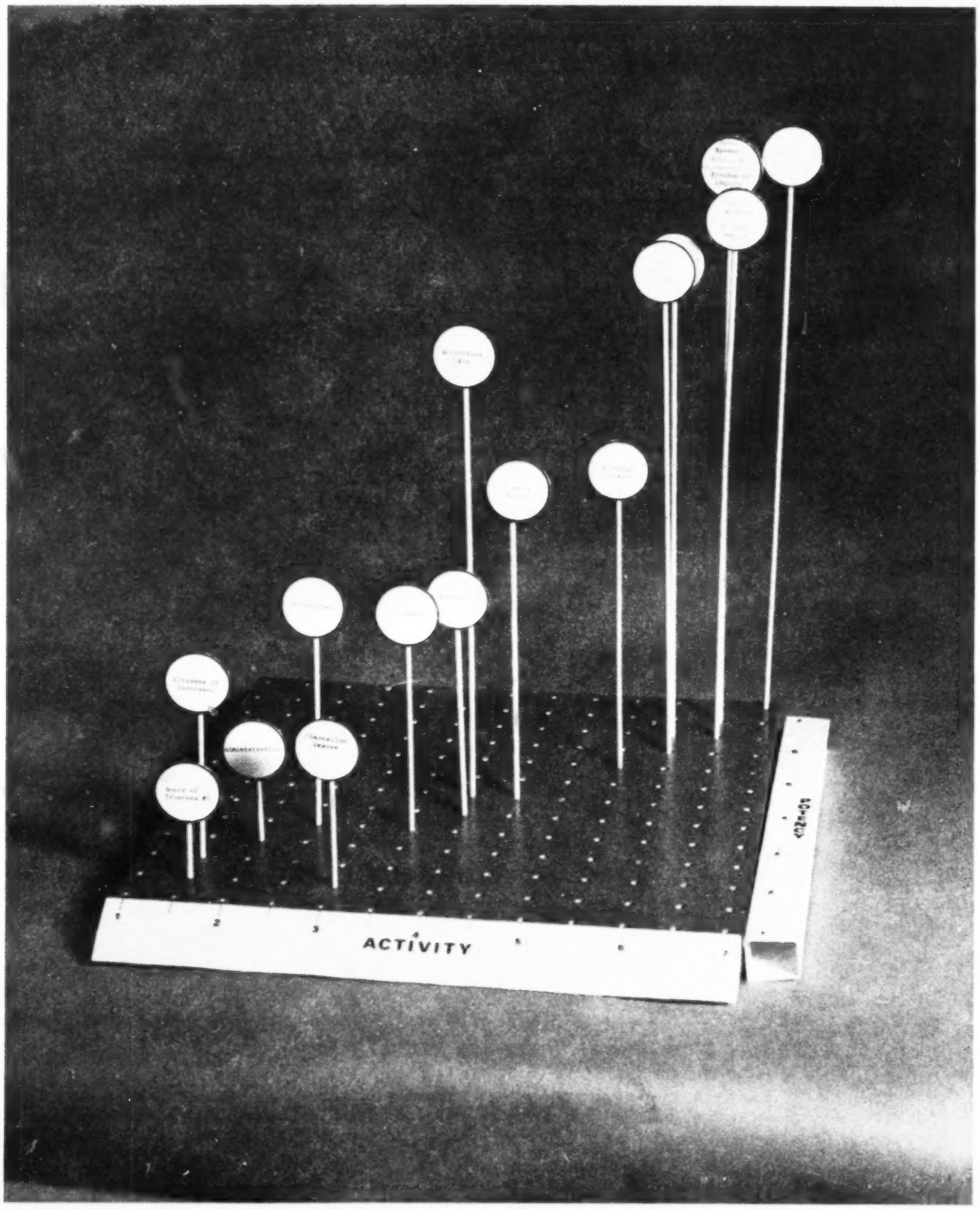


FIGURE 3. OPEN-SPEAKER POLICY, FACTOR MEANS OF MALE GOVERNMENT LEADERS

(N=4)

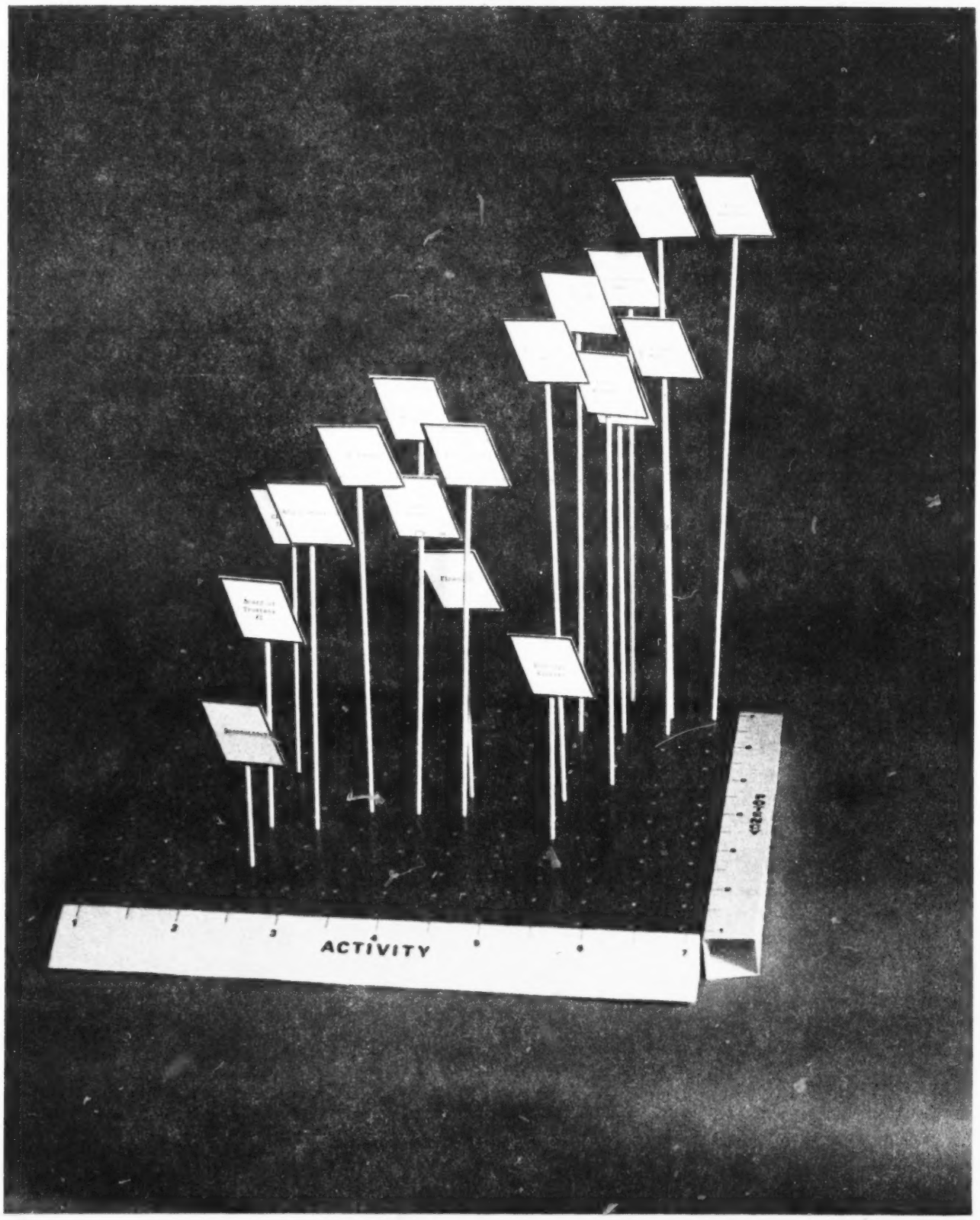


FIGURE 4. OPEN-SPEAKER POLICY, FACTOR MEANS OF WOMEN STUDENT GOVERNMENT LEADERS

(N=3)

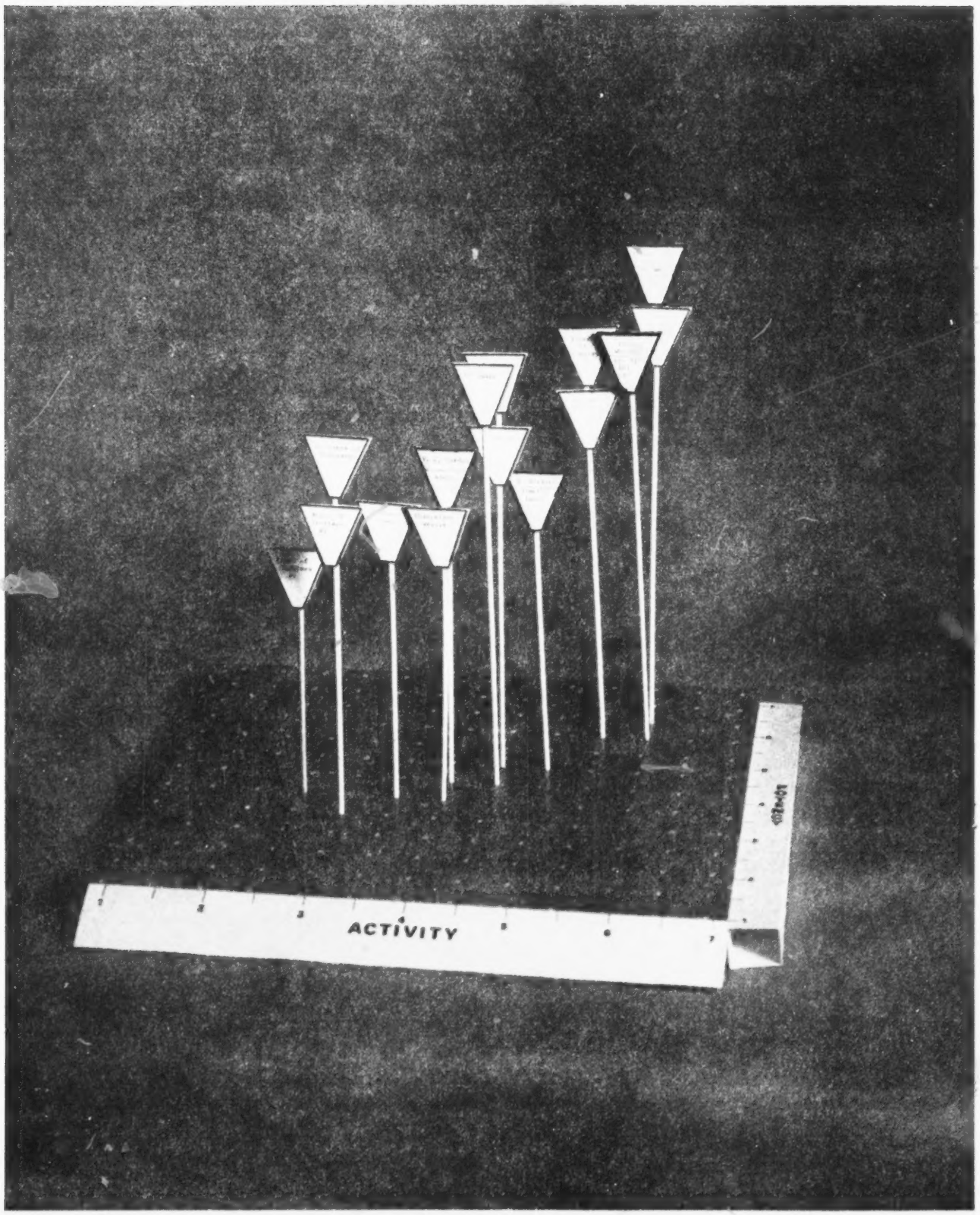


FIGURE 5. OPEN-SPEAKER POLICY, FACTOR MEANS OF GIRLS IN AN UNDER GRADUATE DORM

(N=23)

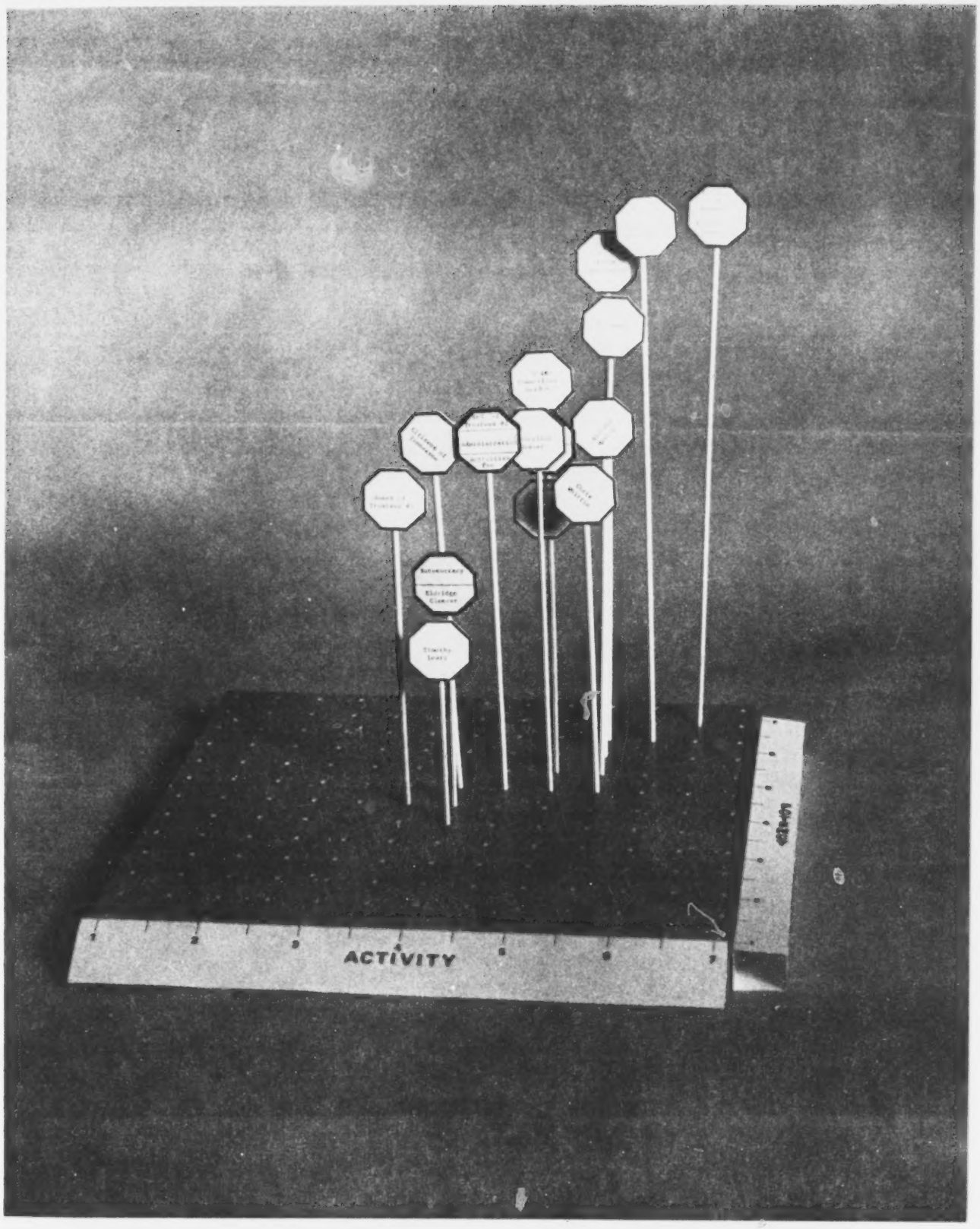


FIGURE 6. OPEN-SPEAKER POLICY, FACTOR MEANS OF HOME ECONOMICS SENIOR SEMINAR STUDENTS

(N=26)

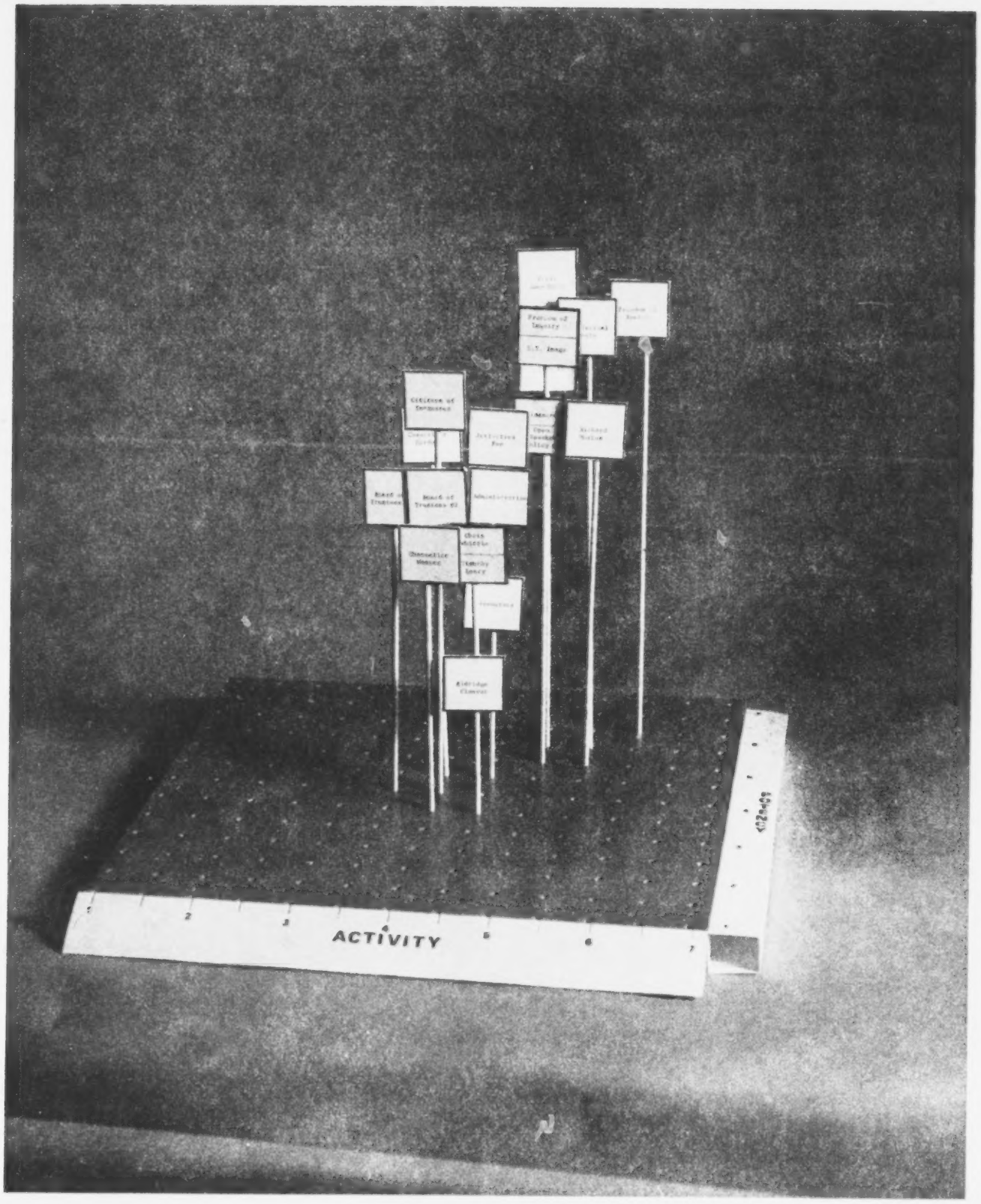


FIGURE 7. OPEN-SPEAKER POLICY, FACTOR MEANS OF FRATERNITY MEN

(N=23)

Dropout Study

Another study (Berryman, 1970) conducted in the spring of 1970 attempted to assess 16-year old students' perceptions of school and nonschool concepts. Figures 8 and 9 present the mean factor scores resulting from responses of students in two different schools to the same personality concepts. Students attending an all black high school (School 1) provided the data in Figure 8 and Figure 9 presents data from an all white high school (School 2). The three separate clusters of personalities shown in Figure 8 are strikingly different from the lack of clusters in Figure 9. Figures 10 and 11 plot the mean scores from students in the school 2 to role concepts and general concepts, respectively.

Although each illustration presents the mean from a group separately, it is often desirable to display results in different formats. With each label shape representing a different group, it is easy to set up a single display which plots the means of various groups to selected concepts. For example, a display of School 1 and School 2 factor means to the personality concepts of Martin Luther King, James Brown, Ted Kennedy, Johnny Cash, President Nixon and the Iron Butterfly would lead to interesting questions regarding differences between the two student bodies.

Perceptions of Institute Participants

Another study (Heller, 1971) conducted during the summer of 1970 assessed perceptions of participants to concepts related to an institute before and after the one week activity. In displaying the results of this study, shapes were again used to distinguish between groups. With differential shading or coloring of labels, the variable of time (pretest/posttest) can easily be added.

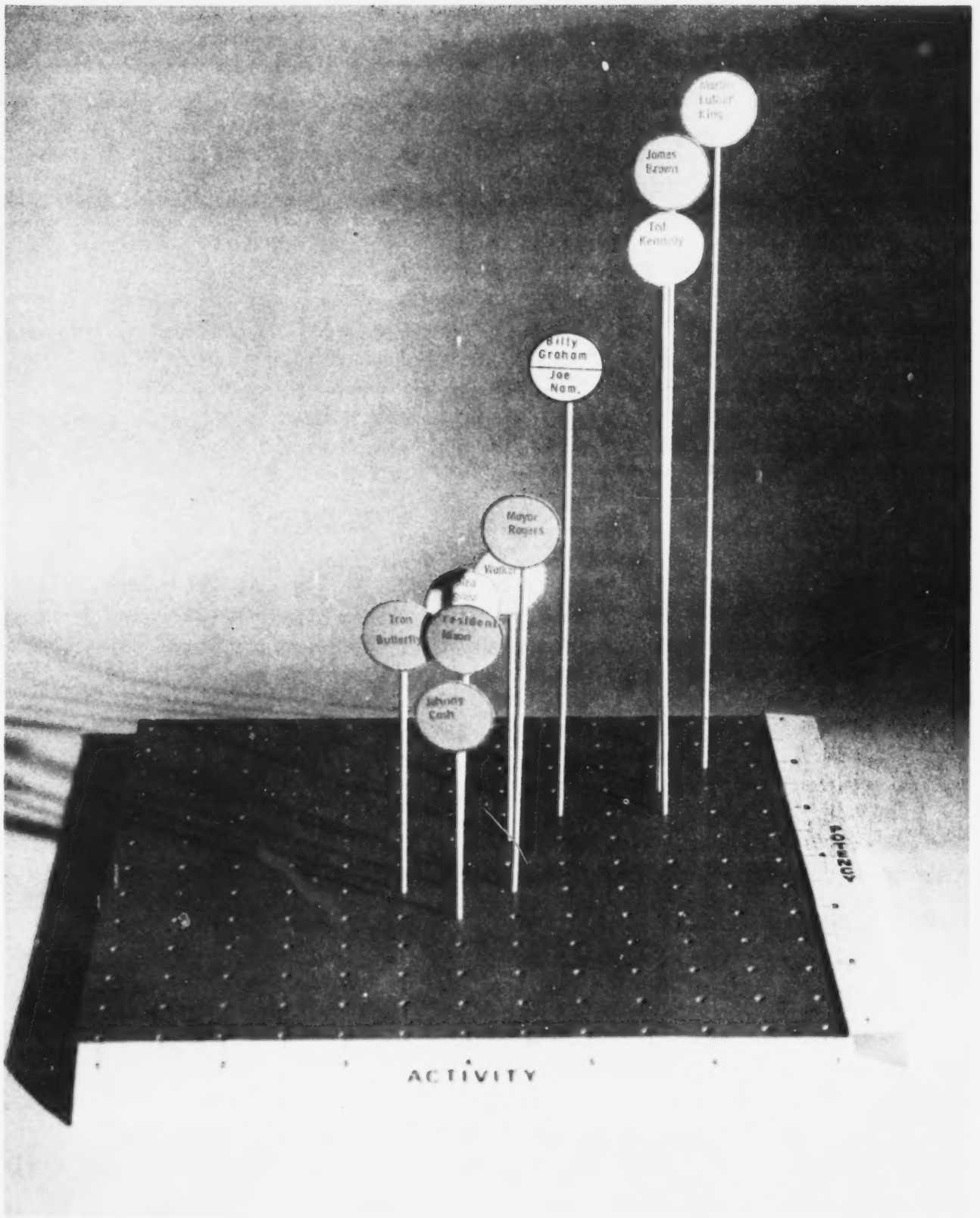


FIGURE 8. FACTOR MEANS OF PERSONALITY CONCEPTS, SCHOOL 1

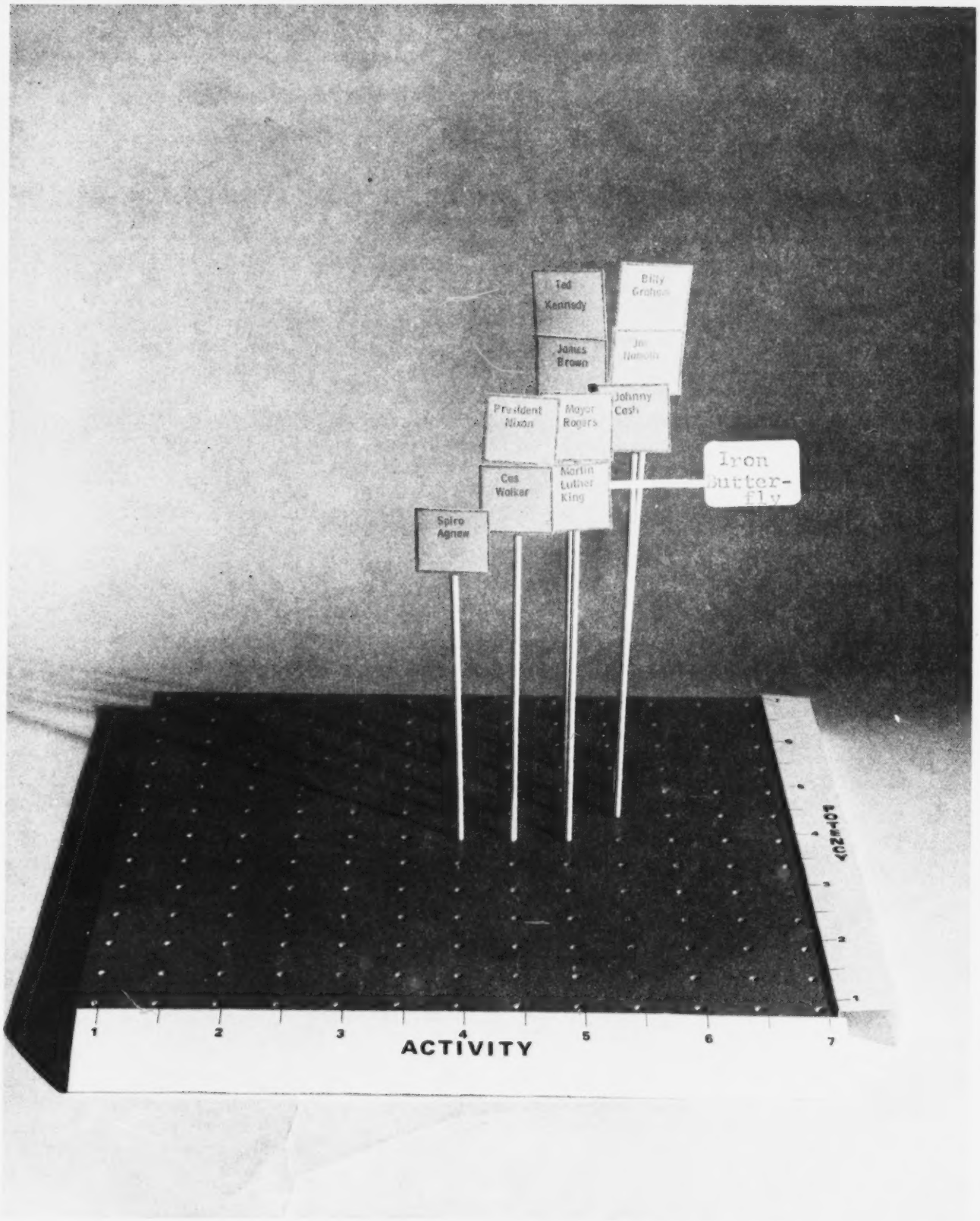


FIGURE 9. FACTOR MEANS OF PERSONALITY CONCEPTS, SCHOOL 2

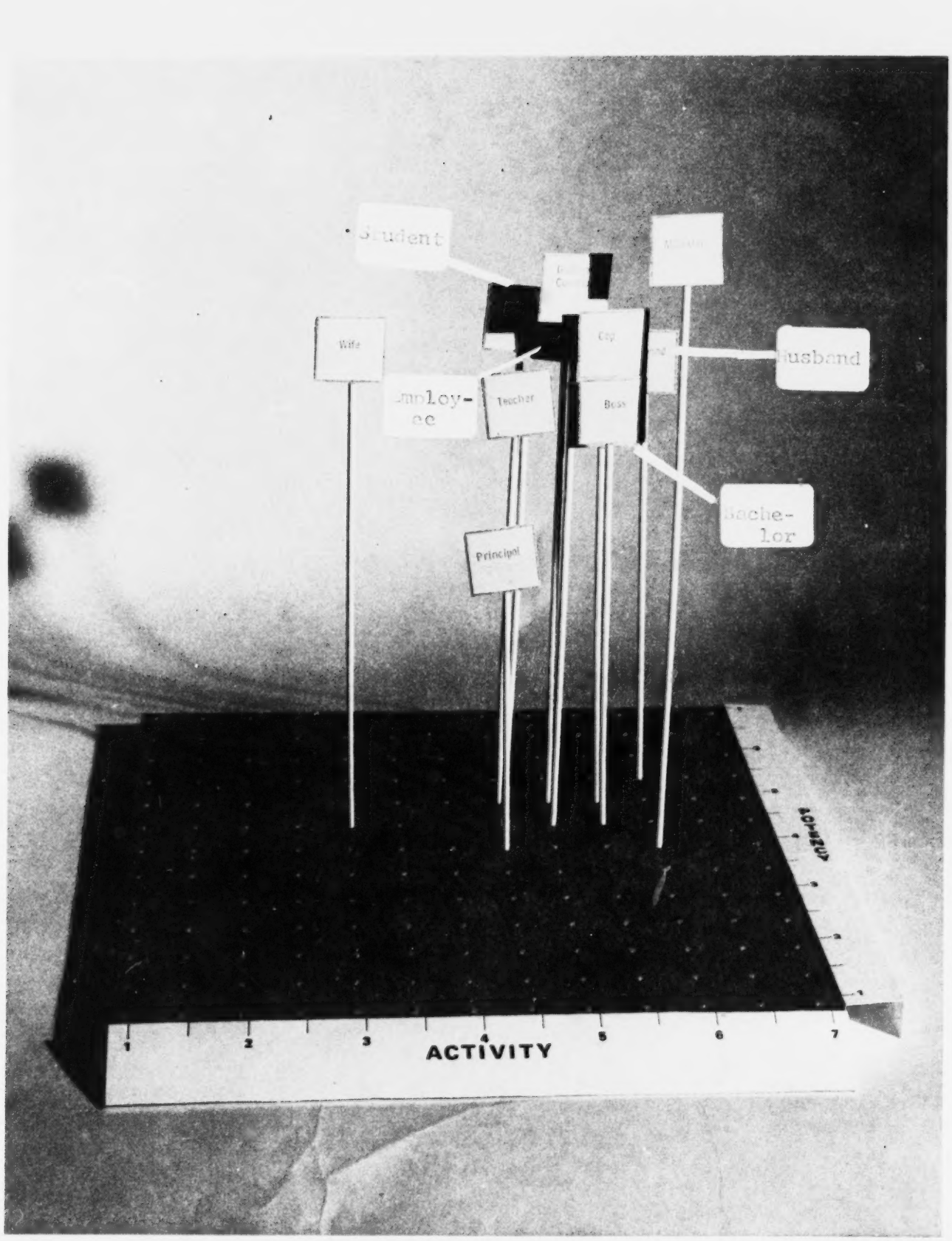


FIGURE 10. FACTOR MEANS OF ROLE CONCEPTS
SCHOOL 2

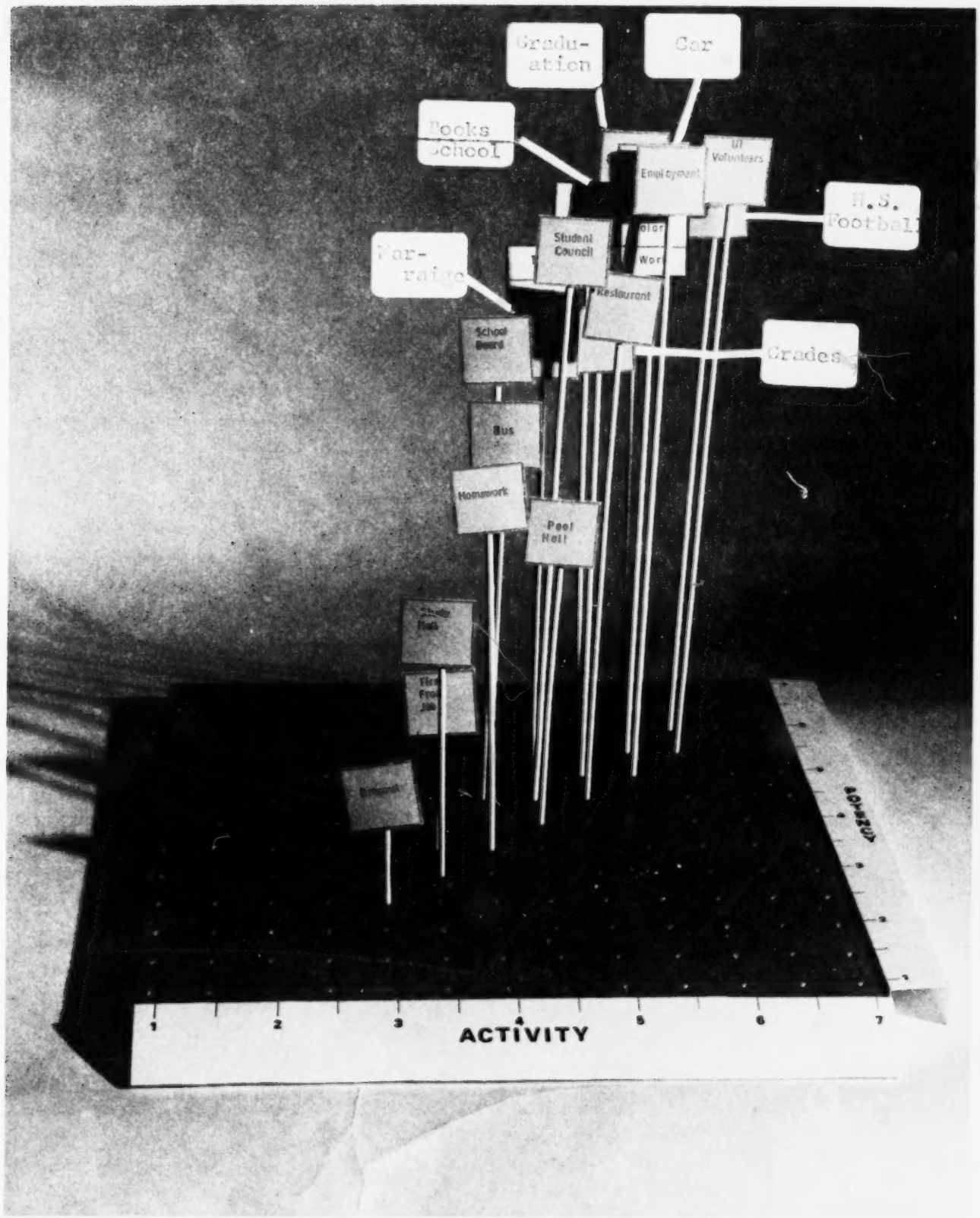


FIGURE 11. FACTOR MEANS OF GENERAL CONCEPTS, SCHOOL 2

Instrument Construction

The remainder of this paper will deal very briefly with selected aspects of the construction of the SD instrument. Just as the researcher is faced with a variety of variables to analyze, he also is faced with a variety of alternatives as to how the instrument will be constructed. The order of concept presentation must be determined, as must the order of scales presented with each concept. In addition, the more critical questions of which concepts and which scales must be answered.

Techniques used by the author in the three studies cited seem helpful in answering some of the questions. The first approach utilized mark-sense punched cards with a single concept and scale on each card (Towne 1967). In other studies the more handy mark-sense sheets were utilized. Figure 14 illustrates one sheet of an SD instrument used in a study of perceptions toward various communications concepts. The concepts, scales and codes were applied to pre-printed mark-sense sheets by the multilith process. With the aid of a competent printer it is possible to print in two separate runs, a variety of concept patterns and scale patterns. With such opportunity to provide variety, it is a relatively simple matter to counterbalance and alter order as desired.

The communications study illustrates this point. Each subject reacted to 20 concepts on each 3 scales. However, these concepts and scales were not the same for all subjects. Through systematic and random sampling each group of subjects reacted to a total of 56 concepts on 9 separate scales (3 per factor).

The concepts employed in this study were of both general and specific nature. The eleven general concepts were presented to all subjects with one scale from each of the three factors. Two of these general concepts were each paired with 18 related concepts which were of a more specific nature. These specific concepts were printed and collated in a manner which resulted in a 1/6 sampling within each group for each concept on each scale. Three other general concepts were each paired with 3 specific concepts. Again printing and collating allowed sampling within each subject group (a 1/3 sample of total for each concept on each scale).

In addition to sampling concepts and scales, the instruments also were designed to counterbalance for origin of endpoint. Half the scales were presented with the "good" endpoint on the right, while the others presented the "good" word on the left. (Other variables were sampled in the same study, but time does not allow for adequate discussion at this time.)

Instruction

Passive ▯▯▯▯▯▯▯ Active

Information

Active ▯▯▯▯▯▯▯ Passive

Research

Passive ▯▯▯▯▯▯▯ Active

Field Services

Active ▯▯▯▯▯▯▯ Passive

Myself as an Educator

Passive ▯▯▯▯▯▯▯ Active

Communications

Active ▯▯▯▯▯▯▯ Passive

Media

Passive ▯▯▯▯▯▯▯ Active

Faculty Morale

Active ▯▯▯▯▯▯▯ Passive

Publications

Passive ▯▯▯▯▯▯▯ Active

Service

Active ▯▯▯▯▯▯▯ Passive

Public Relations

Active ▯▯▯▯▯▯▯ Passive

Communications among Administrators

Passive ▯▯▯▯▯▯▯ Active

Internal Reports

Active ▯▯▯▯▯▯▯ Passive

Educational Research

Passive ▯▯▯▯▯▯▯ Active

Students

Active ▯▯▯▯▯▯▯ Passive

Esprit De Corp

Passive ▯▯▯▯▯▯▯ Active

Communications between College of Education and Citizens of State

Active ▯▯▯▯▯▯▯ Passive

Internal Communications

Passive ▯▯▯▯▯▯▯ Active

External Communications

Active ▯▯▯▯▯▯▯ Passive

Student Involvement

Passive ▯▯▯▯▯▯▯ Active

FIGURE 12. SAMPLE PAGE OF MARK-SENSE SD INSTRUMENT

The possibilities of complex research designs using this technique are numerous. The difficulty is not with scoring the instrument, which is done electronically, but in preparing the instrument. The brackets appearing at the top of the sheet (Figure 14) are used to code the level of each instrument variable appearing on that sheet. It is also possible to add other data to this area, such as subject I.D. number, the time of administration and similar relevant information.

SUMMARY

A procedure for displaying large amounts of data in three-dimensional space has been presented. Such displays have greatly facilitated the conceptual analysis of different studies, as well as the reproduction of such data in printed format.

BIBLIOGRAPHY

Berryman, Carolyn. A Descriptive Study of Attitudes, General Adjustment, and Morale of High School Students. Master Thesis, University of Tennessee, Knoxville, Tennessee, 1970. 83 p.

Heise, David R. "Some Methodological Issues in Semantic Differential Research.[1]" Psychological Bulletin: 1969. Vol. 72, No. 6, pp 406-422.

Heller, Steven. The Effects of a Five Day Institute on the Attitudes of Black and White Public School Participants. An Occasional Paper Published by the Educational Opportunities Planning Center, University of Tennessee, Knoxville, Tennessee. 1971. (In Press)

Osgood, Charles E., Suci, George J. and Tannenbaum, Percy H. The Measurement of Meaning. University of Illinois Press, Urbana, 1967. 342 p.

Towne, Douglas C. Influences Exerted Upon Subject Responses By The Response Scale Structural Elements Of Attitude Scales. Unpublished Doctoral Dissertation, Cornell University, 1967.